

Modular RadialHeat Oud Heating Ecosystem

Public Disclosure Document - Rev-D

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0. Executive Summary

The RadialHeat Oud Heating Ecosystem revolutionizes how oud (agarwood) and other aromatics are enjoyed in rituals, meditation, and perfumery. Traditional methods—Japanese Kōdō (complex, 10–15 min setup) and Arabic Bukhoor (harsh, $>350^{\circ}\text{C}$)—waste high-grade oud due to inconsistent heating. Our modular, charcoal-based system delivers precise $180\text{--}280^{\circ}\text{C}$ heating in a portable, elegant package, blending ancient flame rituals with modern ease. Think of it as the “USB-C” of incense: a standardized ring-coal hub connects to inserts, cartridges, and burners for consistent, smokeless aroma.

Key Features:

- **Five Inventions:** Variable ring coals, heat-plate rings, self-igniting cartridges, table burners, and reversible cartridges.
- **Precision and Ritual:** Matches electric-heater accuracy with Kōdō-inspired aesthetics.
- **Eco-Friendly:** Coconut-shell charcoal reduces CO_2 by $\sim 60\%$ vs. mangrove.
- **Market Traction:** Prototypes scored 4.3/5 in purity by 12 spa testers; crowdfunding launches Q3-2025.

Visual Aid:

[Insert Infographic: Labeled diagram showing a Gentle ring coal with mica insert, oud chip on a pin, and table burner. Arrows depict radial heat flow and aroma release. Caption: “How RadialHeat Works: Plug-and-Play Oud Heating.”]

1. Problem Statement - Why Oud Lovers Need a New Heater

High-grade agarwood (oud) is wasted daily due to inefficient heating:

- **Japanese Kōdō:** Requires 10–15 min of ash-cone sculpting and charcoal positioning, often under-heating ($<180^{\circ}\text{C}$), yielding faint resin notes before the coal dies.
- **Arabic Bukhoor/Mabkhara:** Drops chips on glowing coal ($>350^{\circ}\text{C}$), scorching resin, producing smoke, tar, and inconsistent scents.

Modern users—spas, perfumers, meditators—demand a fast, repeatable, portable solution that hits the $180\text{--}280^{\circ}\text{C}$ “sweet band” where oud oils vaporize without charring. Current electric heaters ensure consistency but lack ritual aesthetics and off-grid portability.

Goal: Create a modular charcoal ecosystem blending Kōdō’s purity with Bukhoor’s speed, no electronics required.

2. RadialHeat Ring-Coal Standard - The “USB-C” of Incense

USP Call-Out: “First charcoal engineered to heat through the ring, not past it.”
Every invention docks to a standardized annular charcoal spec delivering lateral heat flow.

2.1 Specifications

- **Inner Ø:** 20 ± 0.2 mm (insert seat).
- **Outer Ø Options:** 30/40/50 mm (Gentle/Table/Arabic grades).
- **Height:** 12/15/20 mm.
- **Void Depth:** ≥10 mm.
- **Composition:** 96% coconut-shell charcoal, ≤3% food-grade tapioca starch binder, ≤1% moisture.
- **Bulk Density:** 0.82 g/cm³.
- **Ignition Time:** 35 ± 5 s (butane torch).
- **Burn Time:** 38 ± 2 min (Gentle), 47 ± 3 min (Table), 54 ± 4 min (Arabic).

2.2 Definition of Terms

- **Insert:** Non-combustible part (e.g., mica disc, lava cartridge) placed in ring void.
- **Radial Conduction:** Heat traveling laterally from combustion zone to insert/payload.
- **Payload:** Aromatic material (e.g., oud chip, powder, pre-filled cartridge).

2.3 Why RadialHeat Beats Hookah Rings

Feature	Hookah Rings	RadialHeat Rings
Void Function	Air chimney; no inserts.	Thermal pocket for insert + payload.
Heat Profile	250°C spike, then drop; ash falls on shisha.	180–280°C plateau (±8°C); ash isolated.
Ecosystem	Discrete part; no accessories.	Hub for plates, pins, cartridges, burner stand.

2.4 Comparison with Open-Fire and Industrial Alternatives

Metric	RadialHeat Ring Coal	Candle-Heated Oud	Direct Flame Incense	Matrix Heat Recovery Unit (MHRU)

Heat Profile	180–280°C (±8°C)	140–190°C (±25°C)	300–600°C (uncontrolled)	200–500°C (industrial)
Aroma Purity	No volatiles; ash isolated	Wax/wick fumes	Smoke, tar	N/A (no aromatics)
Prep Time	30–45 s	5–7 min	<2 min per chip	N/A
Portability	Fully portable	Limited (wax spill)	Portable (ember risk)	Fixed, industrial
Ritual Aesthetics	Flame + vapor	Candle glow	Harsh smoke	None

Note: Industrial systems like MHRU use radial heat transfer but are irrelevant to portable, ritualistic oud heating, lacking inserts or aromatic payloads.

3. Invention 1 - Variable Ring-Coal Sizing (Fuel Module)

Three calibrated rings share a 20 mm inner Ø, compatible with one insert. Temperature measured 2 mm above payload (K-type thermocouple):

Grade	OD × H (mm)	Plateau °C (μ ± σ)	Burn Time (min)	Suggested Scenario
Gentle	30 × 12	195 ± 7	38	Solo kyara sniffing, tea meditation
Table	40 × 15	222 ± 8	47	Spa room, two-person ceremony
Arabic	50 × 20	262 ± 9	54	Majlis, fragrance layering

Why It Works:

- Radial conduction + calibrated charcoal mass ensure ±8°C stability (vs. ±25°C for disc-on-coal).
- Coconut briquettes cut mangrove deforestation, reducing CO₂ by ~60% per session.

Visual Aid:

[Insert Graph: X-axis = Time (min), Y-axis = Temperature (°C). Three lines show Gentle (195°C), Table (222°C), Arabic (262°C) plateaus, each ±8°C. Caption: “Stable Heat Profiles for Every Scenario.”]

4. Invention 2 - Integrated Heat-Plate Ring (Hybrid Fuel + Insert)

Construction:

- **Ring:** Table size (40 × 15 mm) briquette.
- **Disc:** Laser-cut mica sheet, Ø 19.8 mm, 2 mm thick, $\lambda = 0.8 \text{ W/m}\cdot\text{K}$.
- **Pin:** 304 stainless steel, Ø 1.2 mm, 4 mm high, press-fit through mica.
- **Placement:** Disc sits 2/3 down void; 4 mm air gap below payload.

Operating Profiles:

Mode	Assembly	Surface °C	Aroma Lead-Time
Standard	Chip on disc, ring around	220 ± 6	45 s
Boost	Disc as lid, ring on top	255 ± 7	30 s

Advantages:

- Stored heat in disc flattens temperature curve.
 - Pin suspends odd-shaped chips, preventing ash contamination.
 - Manufacturing leverages hookah-ring presses + laser station (COGS +\$0.22).
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5. Invention 3 - Self-Igniting Oud Cartridge (All-in-One Pod)

Specifications:

- **Dimensions:** Ø 19.8 × H 8 mm.
 - **Charge:** 0.4 g quick-light briquette with 0.7% potassium nitrate + vegetable glue.
 - **Insert:** 1.8 mm mica disc bonded underneath.
 - **Payload:** 0.15 g oud chip (or 15 mg kyara in premium SKU).
 - **Performance:** 205 ± 10°C for 18 min; 8 s ignition-to-aroma.
 - **Shelf Life:** 24 months in aluminum blister pack (0.5% Δ mass).
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6. Invention 4 - Modular Table Burner (Support Module)

Purpose: A reusable, portable burner that supports RadialHeat ring coals and inserts, ensuring stable alignment and airflow for consistent oud heating.

Hardware Specs:

- **Body:** CNC-spun 304 stainless steel dish, Ø 70 mm, 0.8 mm wall, 48 g.
- **Vent Pattern:** 12 radial slots (3 × 15 mm), lotus-petal inspired (design-patent candidate).

- **Alignment Guide:** Central 20 mm Ø ridge (0.5 mm high, CNC-machined) to position the mica plate.
- **Legs:** M4 threaded stainless steel posts, 20 mm, silicone feet; unscrew for hand warmer use.
- **Finish:** PVD matte-bronze (spa line), raw stainless steel (artisan line).

Alignment Mechanism:

- **Mica Plate:** Laser-cut mica disc (Ø 19.8 mm, 2 mm thick, $\lambda = 0.8 \text{ W/m}\cdot\text{K}$) with raised borders ($\text{Ø } 20.0 \pm 0.05 \text{ mm}$, 0.5 mm high) to fit snugly within the coal ring's $20 \pm 0.2 \text{ mm}$ inner void.
- **Central Pin:** Titanium GR2 (Ø 1.0 mm, 4 mm high, food-contact compliant), press-fit to secure oud chip and stabilize the mica plate.
- **Operation:** The mica plate is placed on the burner's central ridge. The ignited coal ring (Gentle, Table, or Arabic) slots over the mica's borders, aligning the ring within ~1–2 mm of center. The pin holds the oud payload, ensuring even radial heating (e.g., $222 \pm 8^\circ\text{C}$ for Table grade).

Performance:

- **Thermal Efficiency:** Elevation via legs extends Gentle ring plateau by +4 minutes due to optimized airflow (12 vent slots).
- **Alignment:** Mica borders ensure ~1–2 mm centering, sufficient for irregular oud chips (0.15 g), maintaining 180–280°C sweet band.
- **Durability:** Mica plate withstands 10 burn cycles without cracking (per validation data).

Advantages:

- Simplifies setup by eliminating magnetic components, reducing COGS (~\$2.85–\$3.00 vs. \$3.35).
- Eco-friendly design avoids rare-earth magnets, aligning with coconut charcoal's 60% CO₂ reduction.
- Tight tolerances (mica $\text{Ø } 20.0 \pm 0.05 \text{ mm}$, coal $\text{Ø } 20 \pm 0.2 \text{ mm}$) ensure reliable fit, even after thermal expansion.

Manufacturing:

- CNC machining adds a 20 mm ridge to the burner (~\$0.10 COGS).
- Mica borders formed via laser-cutting or bonding (~\$0.03–\$0.05 COGS).
- Total burner COGS: ~\$2.85–\$3.00, enabling ~\$27–\$28 retail with 88% gross margin.

Visual Aid:

[Insert Diagram: Cross-section of burner with mica plate (borders visible), coal ring slotted over, and oud chip on pin. Arrows show radial heat flow. Caption: "Mechanical Alignment for Simple, Precise Heating."]

7. Invention 5 - Reversible Drop-In Cartridge (Insert Module)

Specifications:

- **Core:** Porous lava bead (basalt), Ø 19.5 × H 3 mm, 22% porosity.
 - **Mica Laminate:** 0.8 mm sheet bonded beneath.
 - **Pin:** Removable titanium GR2, Ø 1.0 mm, food-contact compliant.
 - **Modes:**
 - **Drop-In:** Cartridge in ring void (210°C radial heating).
 - **Foundation:** Cartridge on tray, ring over (245°C vertical + radial).
 - **Tolerance:** OD -0/+0.05 mm ensures snug fit post-expansion.
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8. Draft Claim Set

- **Independent Claim:** An annular heat source dimensioned to receive an insert bearing oxygen-sensitive aromatics, wherein combustion gases are prevented from direct contact with the aromatics.
 - **Dependent Claim:** The heat source of claim 1, wherein the insert comprises mica, porous lava, or basalt; includes a central pin; and is seated 40–80% of ring height.
 - **Dependent Claim:** The heat source of claim 1, wherein the insert maintains a surface temperature of 180–280°C for at least 25 minutes.
 - **Dependent Claim:** The heat source of claim 1, comprising at least 90% coconut-shell charcoal to reduce environmental impact.
 - **Dependent Claim:** The heat source of claim 1, further comprising a ventilation warning compliant with ISO 13571 for safe operation.
 - **System Claim:** A kit containing at least two ring sizes and one reversible cartridge enabling radial and vertical heat vectors.
 - **Dependent Claim:** The kit of claim 6, further comprising a support module with a mica insert having raised borders dimensioned to fit within the annular heat source's inner void, configured to align the heat source within 2 mm of the module's center.
 - **Method Claim:** A method comprising: (i) selecting a ring grade by temperature chart, (ii) placing payload, (iii) igniting, (iv) allowing radial conduction to volatilize aromatics within 30–60 s.
 - **Design Claim:** An ornamental lotus-vent pattern on a support stand for aromatic heating.
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9. Performance-Validation Plan

Test	Metric	Target	Result (Proto A)
Thermal Plateau	$\sigma < \pm 10^{\circ}\text{C}$ for 25 min	Pass	Pass (Gentle & Table)
GC-MS PAH vs. Direct Coal	-30% or better	Pass	-32%
User Sensory Panel (Purity 1–5)	≥ 4	Pass	4.3 avg (n=12)
Structural Integrity Post-Burn	No crack/warp	Pass	No defects (10 cycles)

Visual Aid:
[Insert Chart: Bar graph comparing PAH emissions (mg/kg) for RadialHeat vs. direct coal, showing 32% reduction. Caption: “Cleaner Aroma with RadialHeat.”]

10. Risk & Compliance Matrix

Risk	Mitigation	Standard
Finger Burn	Ventilation warning on pack	ASTM F2058
Salt Off-Note	Pure-Lite SKU	N/A
Child Access	ISO 8317 foil packaging	EN 862
Combustion CO	Ventilation warning	ISO 13571
User Misalignment	Central ridge on burner; pictogram instructions	N/A

Future Compliance: Electric add-on planned for UL 1482 / CSA B366 certification.

11. Prior-Art Log

Reference	Description	Gap vs. RadialHeat
XYZ Hookah Ring	Airflow chimney; no inserts	No thermal pocket or ecosystem
Tennen Kōdō Ash + Mica	15 min ash bed setup	Lacks portability, standardization

Electric Heater	Mains-powered, no flame	No ritual aesthetics, off-grid use
Matrix Heat Recovery Unit	Industrial radial heat exchanger	No aromatic or portable application
Radiant PEX Systems	Fixed, large-scale heating	No modular charcoal or ritual focus

12. Manufacturing Snapshot (10k Units)

SKU	Process	COGS	Retail	Gross %
Gentle Ring	Briquette press	\$0.16	\$2.20	92%
Table Ring	Briquette press	\$0.18	\$2.50	93%
Heat-Plate Ring	Press + laser seat	\$0.48	\$5.50	91%
Table Burner	CNC + PVD	\$2.85	\$27.00	89%
Cartridge 3-Pack	Press + blister	\$0.95	\$9.00	89%

Note: Table Burner COGS reduced from \$3.35 due to mechanical alignment (no magnet, +\$0.10 for ridge).

13. Commercialization Roadmap

- **Q3-2025:** Crowdfund artisan line; ship Gentle starter kit. [Pre-campaign: 150+ spa owners expressed interest on Indiegogo.]
- **Q4-2025:** Onboard spa/retail partners; launch cartridge subscription.
- **H1-2026:** OEM supply to luxury perfume houses; release UL-compliant electric adapter.

Market Traction:

- Prototype testing with 12 spa owners yielded 4.3/5 purity score.
 - In discussions with [anonymized] perfume house for OEM cartridge supply.
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14. Legal Notice

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